# Portland Harbor FS Sections 3 & 4

Presentation to the Lower Willamette Group July 31, 2015

Kristine Koch, U.S. EPA

# **Objectives**

- Development of the Alternatives
- Screening of the Alternatives
- Detailed Analysis
- Comparative Analysis

# All you need to know...

Table 4.3-2. Summary of Comparative Analysis for Remedial Alternatives

	1	1 hreshok	l Gireia	Selenting Criteria							
Remedial Alternative	Decripion	Overall Projection of Human Health and the Environment	Compliance with ACAPS	Long-term & Negriveness and Permanence	Medicaion of Iosiciny Mobility, or Volume through Treatment	Short-term Effectiveness	Implemen rability	Present Malue (bs : (Dollars)			
Contaminated Sediment Alternatives											
*	haèarlaryha fumber Acrian			NA	NA	NA	NA.	NA			
ь	Briedge 60 schet, Comstnik sches Briedge/Op Stornet, Christ (Boschet MhR2, 250 schet, Instru 7 sche Dietru 301, 170 ev, Obpenst 660,000 cv							<b>*</b>			
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# FS Section 3

Development of Alternatives

#### Development of Alternatives

- Combination of technologies
  - Used for all alternatives, except Alternative A
- Technologies include:
  - Dredging
  - Capping
  - In-situ treatment
  - Ex-situ treatment
  - EMNR
  - MNR
  - ICs

#### Treatment Assumptions

- PTW and groundwater plumes
- In-situ Treatment
  - Activated carbon
  - Organophilic clay
  - Solidification/stabilization (under structures)
- Ex-situ Treatment
  - Thermal desorption

#### Principal Threat Waste

- Source Material NAPL
  - Chlorobenzene Arkema
  - PAHs Gasco
- Highly Toxic exceeds 10<sup>-3</sup>
  - PCBs
  - cPAHs
  - DDx
  - 2,3,7,8-TCDD
  - 2,3,7,8-TCDF
  - 1,2,3,7,8-PeCDD
  - 2,3,4,7,8-PeCDF
  - 1,2,3,4,6,7,8-HxCDF

- > 200 µg/kg
- > 100,000 µg/kg
- > 7000 µg/kg
- $> 0.02 \mu g/kg$
- $> 4 \mu g/kg$
- $> 0.01 \,\mu g/kg$
- $> 0.4 \mu g/kg$
- $>0.3 \mu g/kg$

# PTW - Reliably Contained

Contaminant	PTW Contaminants Reliably Contained			
Dioxins/Furans	Can be reliably contained			
PAHs	Can be reliably contained			
Chlorobenzene	<320 μg/kg			
DDx	Can be reliably contained			
Naphthalene	<140,000 μg/kg			
PCBs	Can be reliably contained			

#### **Ex-situ Treatment Assumptions**

- NAPL & PTW Not Reliably Contained
  - Chlorobenzene
  - Napthalene
  - PAHs
  - DDx mixed with chlorobenzene
- Treatment Method
  - Thermal Desorption

# **SMA Technologies Considered**

- Caps
- Dredging & Excavation
- Dredge/Cap
- Institutional Controls

### Sediment Management Areas

- Based on RALs for Focused COCs
  - PCBs
  - Total PAHs
  - 1,2,3,7,8-PeCDD
  - 2,3,4,7,8-PeCDF
  - 2,3,7,9-TCDD
  - DDx
- Change throughout the alternatives

#### Remedial Action Levels

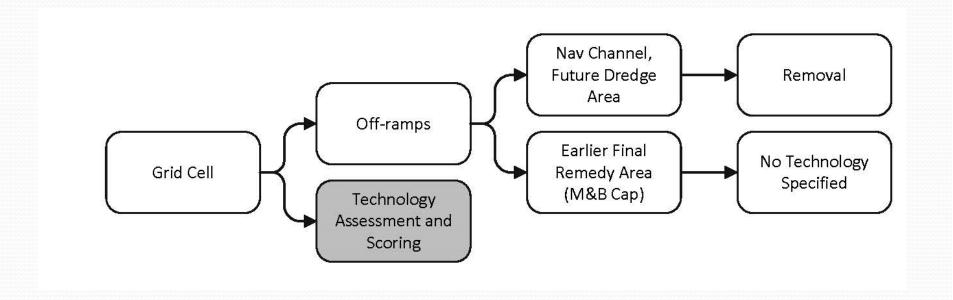
Contaminant	В	C	D	E	F	G
PCBs	1,000	750	500	200	75	50
Total PAHs*	170,000	130,000	69,000	35,000	13,000	5,400
1,2,3,7,8-PeCDD	1	1	1	0.2	0.2	0.009
2,3,4,7,8-PeCDF	0.003	0.002	0.0008	0.0008	0.0008	0.0008
2,3,7,9-TCDD	0.002	0.002	0.002	0.0006	0.0006	0.0006
DDx	650	550	450	300	160	40

<sup>\*</sup>Equivalent to cPAH RALs in draft FS. All units  $\mu g/kg$ .

#### Multi-Criteria Decision Matrix

- Unbiased and reproducible method
- Based on multiple site characteristics
- Uses 10' x 10' grid cells
  - Technology assigned to grid cell
  - Predominant technology w/ smoothing algorithm
- Scored based on multiple criteria
  - Hydrodynamics
  - Sediment bed characteristics
  - Anthropogenic conditions

#### **Technology Assignment Decision Tree**



#### **Technology Assignment Scoring Matrix**

- Criteria Scoring
  - +1 = technology favorable
  - o = technology neutral
  - -1 = technology unfavorable
  - NC = not applicable

Technology A	Technology Assessment Scoring		Armor Cap	EMNR/ Cap	
	Wind/Wave Zone?	1	0	NC	
	Erosive?	1	U	-1	
Hydrodynamics	Depositional? (<2.5cm/year or Subsurface:Surface Ratio>2)?	-1	1	1	
	Shallow?	1	-1	0	
	Slope 15-30%?	1	1	NC	
Sediment Bed Characteristics	Slope >30%	1	0	INC	
	Rock, Cobble, Bedrock Present?	-1	1	1	
	Structures/Pilings?	-1	1	1	
Anthropogenic Influences	Prop Wash Zone?	1	0	NC	
	Moderate or Heavy Debris?	-1 0		1	
	Technology Score		Sum Scores for Each Technology		

#### Delineated Areas for Technology Assignment

- Navigation Channel & FMD
  - Dredging (consistent with LWG Draft FS)
- Shallow (>4 feet NAVD88)
  - Dredge/cap
  - Armor with beach mix
- Intermediate (between Nav Channel and Shallow)
  - Dredge
  - Cap

### Cap Design Assumptions

- Engineered Cap
  - Shallow Areas
    - Physical Isolation Layer: 30 in. sand
    - > Stabilization Layer: 6 in. beach mix
  - Intermediate Areas
    - Physical Isolation Layer: 36 in. sand
- Armored Cap
  - Physical Isolation Layer: 24 in. sand
  - Stabilization Layer: 12 in. armor stone

# Cap Design Assumptions (cont.)

- Reactive Cap
  - Shallow Areas
    - Chemical Isolation Layer: 12-in. sand w/ 5% AC or organophilic clay
    - > Physical Isolation Layer: 18 in. sand
    - > Stabilization Layer: 6 in. beach mix
  - Intermediate Areas
    - Chemical Isolation Layer: 12-in. sand w/ 5% AC or organophilic clay
    - Physical Isolation Layer: 24 in. sand

# Cap Design Assumptions (cont.)

- Armored Reactive Cap
  - Chemical Isolation Layer: 12-in. sand w/ 5% AC or organophilic clay
  - Physical Isolation Layer: 12 in. sand
  - Stabilization Layer: 12 in. armor stone
- Significantly Augmented Reactive Cap
  - Chemical Isolation Layer: 12-in. sand w/ 20% AC
  - Low Permeability Layer: clay (e.g., AquaBlok)
  - Physical Isolation Layer: 18 in. sand
  - Stabilization Layer: 6 in. armor stone
- Institutional Controls

# **Dredging Assumptions**

- Equipment
  - Environmental/closed bucket
  - Articulated fixed-arm dredge w/50 feet arm
  - 2 cu yd bucket around and under structures
  - 4 cu yd bucket
- Productivity
  - 123 days/year (July 1 through October 31)
  - 24 hours/6 days per week

# Dredging Assumptions (cont.)

- Accuracy
  - Natural Neighbors Geostatistical Interpolation
  - Depth based on RALs
  - Maximum dredge depth 15-19 feet
- Residuals
  - 12 in. sand
- Resuspension
  - Silt curtains
  - Rigid containment NAPL (<50 ft water)</li>

# Caps

Alternative	Engineered Cap	Armored Cap	Reactive Cap	Reactive Armored Cap
		Ac	res	
В	0.9	2.8	0	5.5
С	1.7	4.5	0	6.7
D	4.0	8.9	0	10
E	4.8	14	0	15
F	13	48	0	29
G	24	101	0	39

# Dredge and Dredge/Cap Intermediate and NAV/FMD

Alternative	Residual Layer	Reactive Residual Layer	Reactive Cap	Reactive Armored Cap	Significantly Augmented Reactive Cap
			Acres		
В	19	47	0	2.5	0.8
С	25	56	0	2.9	1.0
D	44	80	0	5.2	1.2
E	60	133	0	8.7	1.6
F	209	148	0	15	2.2
G	357	169	0	16	2.3

# Dredge and Dredge/Cap Shallow

Alternative	Backfill	Reactive Residual Layer	Engineered Cap	Reactive Cap	Significantly Augmented Reactive Cap
			Acres		
В	1.7	8.3	0	0.5	1.0
С	2.0	10	1.1	0.6	1.1
D	4.3	12	2.6	1.1	1.1
E	4.1	22	3.4	1.8	1.4
F	11	18	14	5.3	1.4
G	19	18	15	8.7	1.4

#### Disposal Assumptions

- NAPL & Not Reliably Contained
  - Subtitle C
- Alternatives B, C & D
  - Off-site disposal
  - Subtitle D
- Alternatives E, F & G
  - DMM Scenario 1: CDF & off-site disposal
  - DMM Scenario 2: Off-site disposal

### **EMNR** Assumptions

- Swan Island Lagoon
  - Outside SMAs
  - 12 in. sand
- Institutional Controls

#### Remaining Areas

- In-situ treatment for PTW
  - Only if depositional area
  - Activated carbon
- MNR
  - Deposition
  - Dispersion
- Institutional Controls

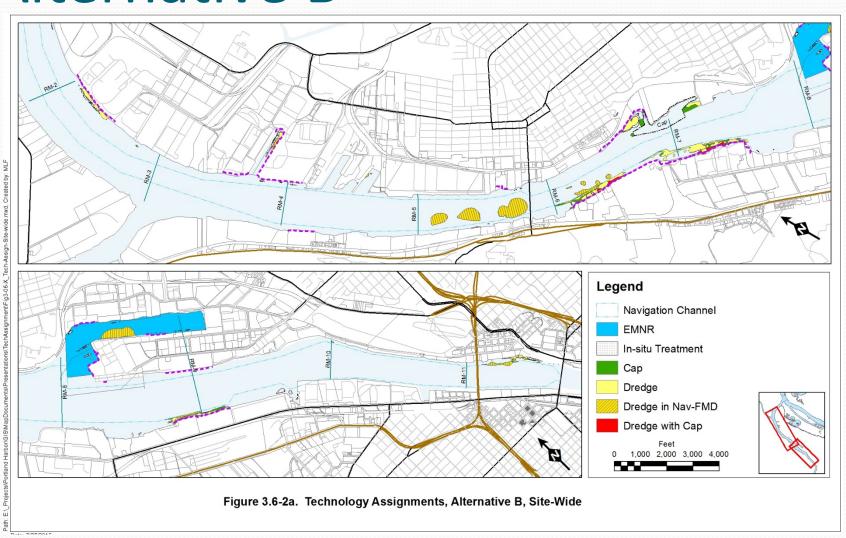
#### **Institutional Control Assumptions**

- Whole River
  - Fish consumption advisories
- Capped Areas
  - Waterway Use Restrictions or Regulated Navigation Areas (RNAs)
  - Land Use/Access Restrictions
- EMNR Areas
  - Land Use/Access Restrictions

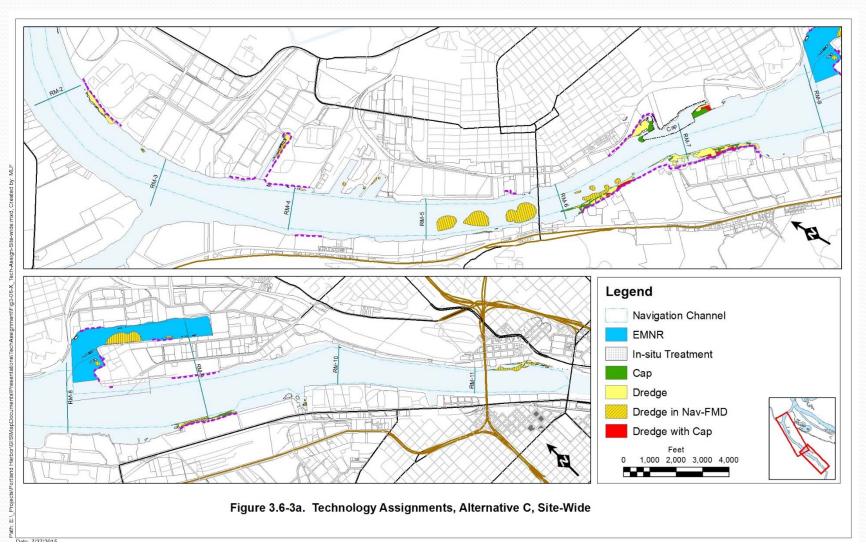
#### **Summary of Technology Assignments**

Alt	Dredge Volume	Dredge Areas	Dredge/Cap Areas	Cap Areas	In-Situ Areas	Ex-Situ Volume	EMNR	MNR <sup>3</sup>	Disposal	Years to Const.
	(Cu Yd)	(Acres)	(Acres)	(Acres)	(Acres)	(Cu Yd)	(Acres)	(Acres)		
В	614,000 to 819,000	70	11	9	7	161,000	103	2,250	DMM 2	4
С	762,000 to 1,016,000	86	15	13	5	177,000	101	2,231	DMM 2	4
D	1,173,000 to 1,564,000	131	21	22	3	198,000	88	2,185	DMM 2	5
Е	2,061,000 to 2,749,000	203	33	34	0	216,000	59	2,121	DMM 1 DMM 2	7
F	4,383,000 to 5,843,000	374	50	90	0	248,000	24	1,912	DMM 1 DMM 2	12
G	6,865,000 to 9,154,000	544	73	163	0	259,000	15	1,655	DMM 1 DMM 2	18

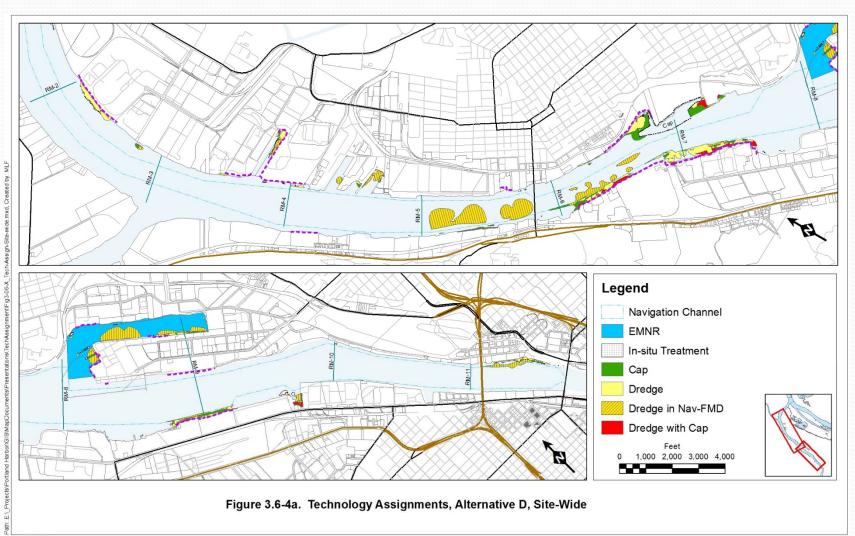
#### Alternative B



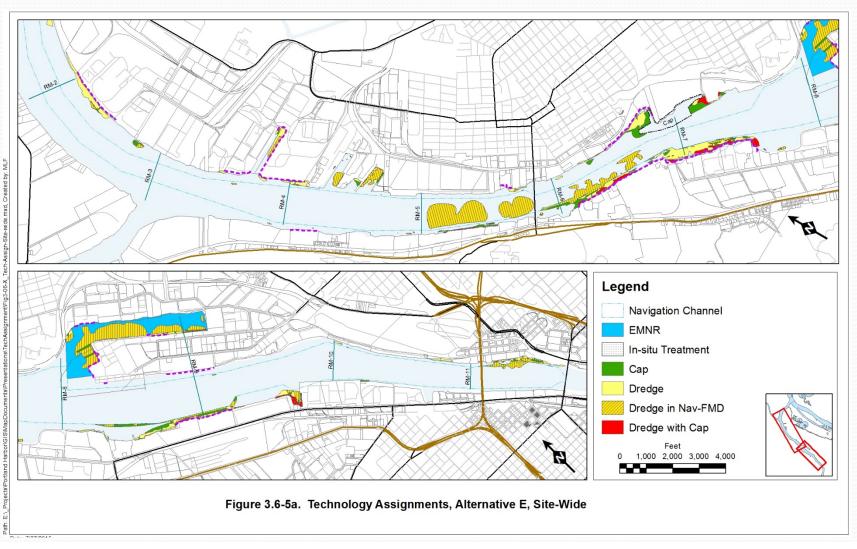
#### Alternative C



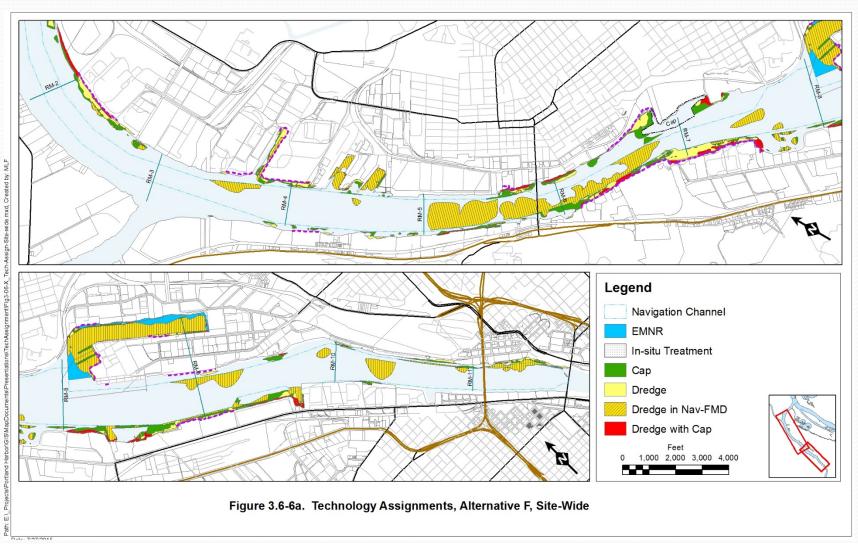
#### Alternative D



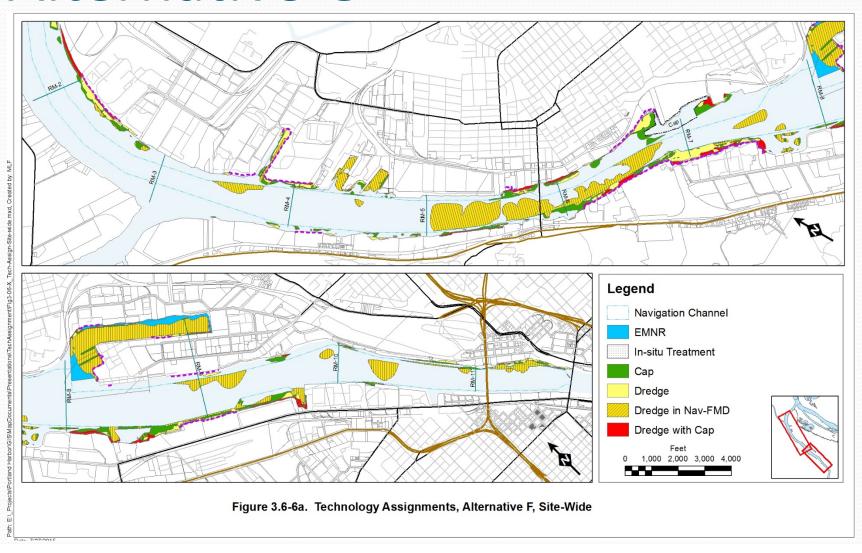
#### Alternative E



#### Alternative F



#### Alternative G



# FS Section 3

Screening of Alternatives

#### **Screened Alternatives**

- Alternative C
  - Essentially same as Alternative B
  - 0.1% increase in overall acres remediated
  - 8.7% reduction of focused COC concentrations

## FS Section 4

**Detailed Analysis** 

#### **NCP** Criteria

- Threshold criteria
  - Overall Protection of Human Health and the Environment
  - Compliance with ARARs
- Balancing criteria
  - Long-Term Effectiveness and Permanence
  - Reduction of Toxicity, Mobility or Volume through Treatment
  - Short-Term Effectiveness
  - Implementability
  - Cost

## Overall Protection of Human Health and the Environment

- Draws on
  - Compliance with ARARs
  - Long-Term Effectiveness and Permanence
  - Short-Term Effectiveness
- Human Health
  - Compare to PRGs for RAOs 1 & 2
  - Qualitative for RAOs 3 & 4
- Ecological
  - Compare to PRGs for RAOs 5 & 6
  - Benthic Risk
  - Qualitative for RAOs 7 & 8

### Compliance with ARARs

- Ensure alternative meets all
  - Chemical specific ARARs
    - > AWQCs national and state
    - > MCLs
    - Oregon Cleanup Laws
    - Oregon Hazardous Substance Laws
  - Action specific ARARs
    - > ESA & EFH
    - > FEMA
    - NHPA & Indian Graves
  - Location specific ARARs
    - > CWA 404
    - Rivers & Harbors Act
    - RCRA
    - Oregon Hazardous Waste & Solid Waste
    - Oregon Water Quality Standards
    - > TSCA

## Long-term Effectiveness and Permanence

- Magnitude of Residual Risk
  - Human Health
    - Rolling river mile by three zones
    - Cancer risks for adult
    - Noncancer hazards for child and infant
  - Ecological
    - > Same as HH
    - Most sensitive receptor
- Adequacy and Reliability of Controls
  - Engineering and Institutional Controls
- Repairs, Maintenance and Remedy Replacement

# Reduction in Toxicity, Mobility & Volume by Treatment

- Treatment processes used
- Amount destroyed or treated
  - principal threat wastes
- Expected reduction
- Irreversible treatment
- Type and quantity remaining

#### Short-term Effectiveness

- Time to Complete Remedy
  - Time for construction
  - Time until RAOs achieved
- Community Protection
  - Transport of wastes and materials
  - "Quality of life issues" from construction
  - Impacts until RAOs achieved
- Worker Protection
  - Risks with construction activities
- Environmental Impacts
  - Effects of construction activities
  - Impacts until RAOs achieved

#### Time to RAOs

- Data (concentrations)
  - RM 16 and 11W sediment traps
    - Mean
    - > 95<sup>th</sup> percentile
    - > 5<sup>th</sup> percentile
- Deposition Rates
  - 4 site-wide rates used by LWG
- SedCam Model
- Spatial Scales
  - SDU
  - River Zones
  - Site-wide

## Implementability

- Ability to construct and operate
- Ease of doing more if needed
- Ability to monitor effectiveness
- Other offices or agencies
  - Obtain approvals
  - Coordinate
- Availability
  - Specialists
  - Equipment
  - Materials
  - Technologies

#### Costs

- Capital
  - Construction
- Annual O&M
  - Monitoring
  - Cap maintenance
- Periodic
  - 5-year reviews
  - Cap replacement
- Present value
  - No discount
  - 7% discount

Not a "cost-benefit" analysis

## FS Section 4

Comparative Analysis

### Qualitative Comparative Analysis

Remedial Alternative	Description	Threshold Criteria		Balancing Criteria				
		Overall Protection of Human Health and the Environment	Compliance with ARARs	Long-Term Effectiveness and Permanence	Reduction of Toxicity, Mobility, or Volume through Treatment	Short-Term Effectiveness	Implementability	Present Value Cost (Dollars)
Contaminated Sediment Alternatives								
А	No Action/No Further Action	<del>_</del>	_	NA	NA	NA	NA	NA
В	Dredge 83 acres; Contain 4 acres	+	+	0	G	•	•	\$
	Dredge/Cap 3 acres; EMNR 103 acres							
	MNR 2,250 acres; In-situ 7 acres							
	Ex-situ 321,120 cy; Disposal 892,000 cy							
D	Dredge 161 acres; Contain 7 acres	+	+	G	•	•	•	\$
	Dredge/Cap 6 acres; EMNR 88 acres							
	MNR 2,185acres; In-situ 3 acres							
	Ex-situ 395,060 cy; Disposal 1,766,000 cy							
E	Dredge 249 acres; Contain 10 acres	+	+	0	•	•	•	\$\$
	Dredge/Cap 10 acres; EMNR 60 acres							
	MNR 2,121 acres; In-situ 0 acres							
	Ex-situ 431,560 cy; Disposal 3,100,000 cy							
F	Dredge 479 acres; Contain 18 acres	+	+	•	•	•	•	\$\$\$
	Dredge/Cap 17 acres; EMNR 24 acres							
	MNR 1,913 acres; In-situ 0 acres							
	Ex-situ 495,830 cy; Disposal 7,115,000 cy							
G	Dredge 741 acres; Contain 22 acres	+	+	•	•	•	0	\$\$\$\$
	Dredge/Cap 18 acres; EMNR 15 acres							
	MNR 1,655 acres; In-situ 0 acres							
	Ex-situ 518,010 cy; Disposal 11,722,000 cy							